formed globe would be identical with that on the earth; for there would be a northern concentration of land, and a southern excess of water; the geographical shapes—except in the case of the two polar units—would be triangular, and land and water would be antipodal.

The agreement between the facts of geography and the requirements of the tetrahedral theory goes further. The main watersheds and mountain systems—which are by no means coincident—have both a tetrahedral plan, forming a girdle in the northern hemisphere and three approximately equidistant meridional lines in the southern hemisphere.

The first obvious objection to the hypothesis of tetrahedroid deformation of the lithosphere is that physicists having proved the rigidity of the earth, any such deformation is impossible. But the arguments in favour of the earth's rigidity apply to the globe as a whole, and do not debar limited deformation of the crust. Such elasticity is now regarded as demonstrated by the movements of the pole, under such trivial influences as the unequal melting of the polar ice or unbalanced falls of snow. The second objection is that the earth is known to be an oblate spheroid, and therefore is not tetrahedrally deformed. But, owing to the equatorial flattening of the world, it is not a spheroid of revolution; owing to the differences of shape between the northern and southern hemispheres, it is not even an ellipsoid. Herschel pithily stated the facts in his remark that "the earth is earth-shaped"; and Listing's term "geoid" is now generally adopted for the figure of the earth. The geoid is, however, by no means a regular figure; the differences between the astronomical and trigonometrical determinations of positions show that the form is subject to numerous deviations, which cannot at present be attributed to any definite system; for accurate observations have not been made over a sufficiently large portion of the earth. But there are suggestions that, like the physical features of the earth, the major geodetic variations may be on a tetrahedral plan; for there is evidence of great deficiency of gravity in two areas (East Russia and Central U.S.A.), which may represent two of the three minima which should occur in the northern land belt. The ordinary explanation of these deficiencies in gravity—viz. that they are due to vast subterranean blocks of light material—is improbable; because in the Russian case the existence of such blocks is disproved by observations on deviations of the plumb-line (Helmert); and in the American case, Mildenhall has shown that no reasonable, or even possible, assumption will explain the facts. The agreement of gravity observations with Bessel's ellipsoid in Central Europe, and their approximation to Clarke's ellipsoid in Eastern Russia (as shown by Helmert), may indicate that both ellipsoids accurately represent the curvatures of the two areas on which they were mainly based, and that they merge into one another along the line of the East African meridional edge.

Geological evidence gives important support to the tetrahedral hypothesis, for the northern land belt appears founded on three great "schild" (Suess) or "coigns" of Archean blocks; these Scandinavian, Canadian, and Manchurian coigns are 120° apart. The significance of the angular distance between them was first pointed out by De Lapparent in the case of the first two. South of the coigns lines of elevation on the meridional edges would be expected; and, though the geological structure of the country along the three lines differs fundamentally, the three lines of recent or still continuing earth-movements of the Andes, Erythrean rift-valley, and East Australian coast occur in the right positions. That tetrahedral geological symmetry is not only an incident of the present, is shown by the distribution of land and water, and by the arrangement of the mountain system at the end of the Palæozoic; for both were on a tetrahedral symmetry. But in that period the present arrangement was reversed, the land belt being southern and the ocean belt northern in position; the position of the meridional land lines was the same as at present.

Such a change in the areas of tetrahedral flattening would be impossible in a stationary world; but in a revolving globe the collapse, due to contraction, is steadily resisted and confined within narrow limits by the effects of the rotation, which tends to restore the world to the more stable spheroidal form. The great mountain building periods of the earth's history may be due to instability resulting from periods of slow deformation; and the periods of great marine transgressions (*e.g.* the repeated Mesozoic transgressions after the mountain elevations at the close of the Palæozoic) are easily explained as due to the restoration of more regular spheroidal form.

Hence the distribution of land and water on the globe may be regarded as the resultant of two opposing forces, collapse due to secular contraction causing deformations, and the tendency due to the earth's rotation towards the recovery of the spheroidal form. The plan of the earth may be attributed to the continuous foundering of the lithosphere in consequence of the unceasing shrinkage of the centrosphere.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Among the lectures announced for this Term may be noted:—Prof. Burdon-Sanderson on general pathology, Dr. Ritchie on special pathology, Prof. Thomson on cranial nerves and digestive system, Prof. Esson on synthetic geometry of conics and cubics, Prof. Turner on mathematical astronomy, Prof. Miers on physical properties of crystals, Mr. Bowman on microscopical examination of crystals, Prof. Elliott on elliptic functions, Prof. Clifton on electricity, Mr. Walker on physical optics, Mr. Goodrich on aves and mammalia, Mr. Bourne on Ctenophora, Prof. Odling on the sugars, Mr. Watts on organic chemistry, Mr. Veley on physical chemistry, Mr. Marsh on stereo chemistry, Prof. Gotch on physiology of the excitable tissues, Mr. Burch on physiological physics, Prof. Sollas on evolution of the earth and on palæontology, Prof. Tylor on development of culture, Mr. Barclay-Thompson on sauropsidan morphology and palæontology. The other lectures announced are more particularly devoted to the general subjects required for the schools.

Elections will be made in the course of the present term to the Sedleian Professorship of Natural Philosophy, vacant by the death of Prof. Bartholomew Price, and to the Linacre Professorship of Comparative Anatomy, vacant by the resignation of Prof. Ray Lankester.

CAMBRIDGE.—The Duke of Devonshire, Chancellor of Cambridge University, presided on Tuesday over a meeting at Devonshire House to consider the financial needs of the University and the establishment of a Cambridge University Association. A full report of the meeting appeared in yesterday's *Times*. The Chairman set forth the various requirements of the University, in buildings and endowments, to meet the increased demands of the day, and said that altogether something like half a million was needed. He announced that he would contribute 10,000*l*. to the endowment fund. A contribution of 10,000*l*. was promised from Lord Rothchild's firm, and the Drapers' Company intimated their intention of contributing 800*l*. a year for ten years in support of a Professorship of Agriculture. It was resolved to form a Cambridge University Association for the purpose of enlarging the resources of the University.

THE following gifts to educational institutions in the United States are announced in *Science*:—The late Henry Clark Warren, of Boston, an accomplished Oriental scholar, has left to Harvard University a large sum principally for the Sanscrit department, but including 10,000 dollars for the Peabody Museum of American archæology and ethnology, and 10,000 dollars for the Dental School. The same University receives 5000 dollars by the will of the late Susan B. Lyman, Dedham, Mass., and 10,000 dollars by the will of the late Mrs. Mary Ann P. Weld, of Boston, the latter sum being for the purpose of founding a Christopher Minot Weld Scholarship. The Teachers' College of Columbia University has received an anonymous gift of 10,000 dollars.

THE Technical Education Board of the London County Council have arranged to award four scholarships of the value of 150*l*. each, tenable from Easter to Christmas 1899, in some higher commercial school or schools on the continent. Candidates must have had experience in teaching commercial subjects, and must possess a good conversational knowledge of the language of the country in which they proposed to hold these scholarships. The Board's object is to afford to teachers who were well acquainted with some branch or branches of commercial education an opportunity of making themselves acquainted with the organisation and methods of the more successful commercial high schools of the continent. Sir Philip

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Magnus has succeeded in arranging for the admission of the Board's scholars to the two principal higher schools of commerce in Paris and to the similar schools in the three Italian towns, Bari, Genoa, and Venice, his suggestions having been most kindly received by M. Bocquet at Paris, and by Signor Fortis, Minister of Industry and Commerce at Rome.

MR. BALFOUR has written a long letter to a constituent in East Manchester on the subject of University education in Ireland. After giving reasons why, in his judgment, the expedient of leaving the one existing teaching University in Ireland—Trinity College—to meet, by a natural process of expansion, the growing educational needs of the country would not be successful, Mr. Balfour suggests that the plan which seems best to solve the University problem, both for the Presbyterians and other Protestants in the north and for Irish Roman Catholics generally. is to establish by a single Act two new teaching Universities—one in Dublin and one in Belfast—on precisely similar lines, and differing in no particular excepting the names of the gentlemen first appointed to serve on their respective governing bodies. As the University in Belfast would absorb the existing Queen's College, the governing body of the new institution should be so constituted as to be a continuation of the old. As the Dublin University is designed to attract those Roman Catholics who now hold aloof from University life altogether, its governing body as first constituted should no doubt, in the main, be of their own way of thinking. A University so constituted would, in Mr Balfour's opinion, meet the need of Roman Catholics, but it would not be a Roman Catholic University, except in the sense that Trinity College and the new University in Belfast would be Protestant, and in that case there would be in Ireland two Protestant Universities to one Roman Catholic.

THE executive council of the County Councils Association passed the following resolutions at a meeting held on January 25: (1) The administrative county (in which term is included the county borough) is *prima facie* to be accepted as the area for secondary education. Nevertheless, provision should be made enabling the council of any county or of any municipal borough to make a representation to the central authority to the effect that it would be desirable, in the best interests of education, that an educational area other than that of the administrative county should be constituted; and if the central authority, after a local inquiry at which all parties interested may be heard, are of opinion that it will be to the best interests of education that such an area should be constituted, they may make an order accordingly. The central authority should be empowered by such order to make such financial adjustments as they may deem equitable and advisable. (2) That the proposal of the Association of School Boards be not approved, and that the executive council, while thinking it desirable that the new local authorities for secondary education in administrative counties should include members of the governing bodies of elementary schools (both board schools and voluntary schools), consider that this will be better secured by a power of cooptation exercised as is recommended in paragraph 36 of the report of the Royal Commission on Secondary Education than by giving any right of separate representation on the new authorities to school boards, which represent parts only of the administrative county.

PROF. S. W. WILLISTON describes in *Science* a remarkable condition of things which exists in Kansas as to the text-books used in the State schools. He says that at the last biennial session of the Legislature of Kansas there was passed what is known as the State uniform text-book law. A commission was appointed whose duty it was to select the text-books of all grades used in the public schools of the State, which were to be furnished at a stipulated price to all pupils. No other text-book than the one selected may be used by any school under pain of severe penalties. The law has now been in force for two years, and these books are being used by several hundred thousand pupils. It appears, however, that specialists or experts are not consulted in the choice of the text-books. Wide latitude was given to the commission, the one important stipulation being that the books should be cheap; and the result is that science manuals are used full of unsound and incorrect statements. The principle of specifying text-books might be a good one if the board which examined the books were wise and representative, and contained a fair proportion of practical teachers; but in Kansas this does not appear to be the case. The School Board of London has a book committee which draws up a list of approved text-books, and a glance at the list is sufficient to show that we need not go to the States for instances of books selected more for cheapness than scientific quality.

SCIENTIFIC SERIALS.

American Journal of Science, January.—The thermodynamic relations of hydrated glass, by C. Barus. During the first or opaque stage of the reaction of hot water on glass at 200° C., volume contraction and increase of compressibility are both marked phenomena. During the second stage the water-glass becomes more and more clear and limpid. Capillary tubes on cooling become rods of brittle water-glass. They always break eventually along their length.—Platinum and iridium in meteoric iron, by J. M. Davison. From 608·6 gr. of Coahuila meteoric iron, 0·014 gr. of metallic platinum were obtained, and 0·0015 gr. of a black powder, which is probably ammonium iridi-chloride. No diamonds were discovered.—Studies in the Cyperaceæ, viii., by T. Holm. This article deals with the root, the rhizome, the aerial stem, and the leaf of some North American species of *Scleria*.—Regnault's calorie, and our knowledge of the specific volumes of steam, by G. P. Starkweather. The writer adduces evidence from Regnault's own experiments to show that his conclusion as to the constancy of the specific heat of water between 0° and 30° is correct. He maintains that all our knowledge concerning the density of steam is limited to the saturation line, the experiments on superheated steam presenting discrepancies which cannot be reconciled.—The estimation of boric acid, by F. A. Gooch and L. C. Jones. The salts are treated with sulphuric acid, and the boric acid is distilled with methyl alcohol, and the distillate evaporated over calcium oxide. In searching for a less hygroscopic material to replace the calcium oxide as a retainer for boric acid, the authors found that sodium tungstate, fused with a slight excess of tungstic acid over that contained in the normal tungstate, answers the purpose excellently.—New Actinians, by A. E. Verrill. Describes a number of new families and genera from Hong Kong, Guadeloupe, Panama, Peru, and San Salvador.—What is the Loess? by F. W. Sardeson. The Loess loam, in combination with land and fresh-water shells, forms a very strong argument in favour of the purely æolian origin of the Loess.—Absorption of gases in a high vacuum, by C. C. Hutchins. The vacuum of Röntgen ray tubes is increased by successive discharges, until it becomes too high for any discharge to pass. This can be prevented by putting some mercuric oxide in a side tube surrounded by a platinum wire heated by a shunt. If a suitable spark gap is inserted in the shunt, the heating may be made automatic. The oxide gives off oxygen when heated, which lowers the vacuum to a proper amount.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, January 27.—Mr. G. Griffith, Vice-President, in the chair.—A mathematical paper was read by Dr. E. H. Barton on the equivalent resistance and inductance of a wire to an oscillatory discharge. Maxwell's treatment of the self-induction of cylindrical conductors was extended by Lord Rayleigh, in an article published in the *Phil. Mag.* for May 1886, to alternate currents that follow the harmonic law at constant amplitude. Dr. Barton now modifies the analysis, and further extends it to include the decaying periodic currents obtained in discharging a condenser, and to the case of damped trains of high-frequency, *i.e.* to Hertz waves in general. The theoretical value (R''/R') for the ratio of equivalent resistances to waves, respectively with and without damping, agrees very well with Dr. Barton's experimental results.—Mr. Oliver Heaviside, in a communication (here abstracted), said that he had by another method of mathematical analysis arrived at the same value as Dr. Barton for (R''/R'). In addition to the causes hitherto suggested as affecting the attenuation factor, it was possible that the conductivity of the wires to vibrations millions per second, might be less than with steady currents, and that the voltage at the beginning of the wave-train might be large

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